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Taxonomic Paper

New distributional data on ascidian fauna (Tunicata: Ascidiacea) from Mandapam coast, Gulf of Mannar, India

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Abstract

Background

Ascidians play a key role in the ecology and biodiversity of marine ecosystem. Ascidians can be transported in ship ballast water and while attached to ship and boat hulls. Heavy traffic by domestic and international ships as well as cargo vessels between the major and minor ports warrants continuous monitoring for new introductions of ascidians. The Mandapam coast is situated in the Gulf of Mannar, India, a marine hot spot area in the Indian Ocean which provides an environment suitable for the settlement of ascidians.

New information

A total of 30 species of ascidians were reported from Mandapam coastal waters, of which 26 species were new to the study area and five species: *Ecteinascidia turbinata*, *Eudistoma carnosum*, *Tridemnum caelatum*, *T. vermiforme* and *Didemnum spadix*, were new to India.

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Keywords

Ascidian, diversity, Gulf of Mannar, India, Mandapam.

Introduction

Ascidians (Class: Ascidiacea and subphylum: Urochordata), commonly called tunicates, are a common, diverse group among the macro fouling communities in marine ecosystems, that attach to natural and artificial substrates in the intertidal and subtidal zones of coastal habitats throughout the world. They are one of the key ecological groups because of their invasive potential. Ascidians have the potential to produce new lead molecules with significant pharmacological activities (Davidson 1993; Rinehart 2000; Haefner 2003 and Jain et al. 2008). Some ascidians have been used for their nutritional value as food for people in many parts of the world including India (Nanri et al. 1992 and Tamilselvi et al. 2010). Certain solitary ascidians serve as indicators of water quality (Abdul Jaffar Ali 2004; Tamilselvi 2008; Abdul Jaffar Ali et al. 2011 and Abdul Jaffar Ali et al. 2015b).

India has a rich natural heritage and nurtures a unique biodiversity, placing it among the 17 most biodiverse countries (Venkataraman 2003). The Gulf of Mannar, located in the southeast coast of India, is a hot spot for Indian marine biodiversity and recognized as Marine National Park. The site provides natural and artificial substrata for the successive settlement, growth and breeding of ascidian species throughout the year.

Mandapam (Latitude 9°28'N and Longitude 79°15'E) is located in Gulf of Mannar and experiences heavy traffic of fishing and defense vessels from various major and minor ports along the Indian coast. Tidal exchange in the area is seasonal. Direction and force of the monsoonal winds influence this station, since the coast line in the east-west direction.

Materials and methods

The study was carried out from March 2014 to February 2015 at Mandapam, India. Collections were made randomly during the study period at intertidal beds and in shallow water regions. Hand tools were used to remove animals from solid surfaces like pillars of jetties, small rocks and hulls of fishing vessels. Snorkeling was also employed to collect ascidians at 1-2 meter depths. Collected specimens were narcotized with menthol and then preserved in 10% buffered formalin in seawater. The specimens were sorted and identified to species or the lowest possible taxonomic level using taxonomic keys (Sebastian 1956; Tokioka 1967; Millar 1975; Kott 1985; Renganathan 1986; Monniot and Monniot 1996 and Kott 2001). Data set of distribution of ascidians throughout the world was obtained from WoRMs.

Taxon treatments

Ecteinascidia thurstoni Herdman, 1906

- Encyclopedia of Life http://eol.org/pages/513367/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Phlebobranchia; family: Perophoridae; genus: *Ecteinascidia*; specificEpithet: *thurstoni*; scientificNameAuthorship: Herdman, 1890; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2015; month: 2; day: 9; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM01; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2015; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/04; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Andaman Sea, Mediterranean Sea - Eastern Basin, Thailand, Djibouti, South Pacific Ocean

Distribution in India: Gulf of Mannar.

Ecteinascidia turbinata Herdman, 1880

- Encyclopedia of Life http://eol.org/pages/513369/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Phlebobranchia; family: Perophoridae; genus: *Ecteinascidia*; specificEpithet: *turbinata*; scientificNameAuthorship: Herdman, 1880; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2015; month: 2; day: 9; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM02; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2015; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/04; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

United States, Djibouti, Gulf of Mexico, Mediterranean Sea, North Atlantic Ocean.

Distribution in India: Mandapam.

Ecteinascidia venui Meenakshi, 1997

- Encyclopedia of Life http://eol.org/pages/513370/overview

Material

a. taxonID: Native; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Phlebobranchia; family: Perophoridae; genus: *Ecteinascidia*; specificEpithet: *venui*; scientificNameAuthorship: Meenakshi, 1997; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 8; day: 27; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM03; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/03; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

India

Distribution in India: Thoothukudi coast.

Symplegma oceania Tokioka, 1961

- Encyclopedia of Life http://eol.org/pages/515533/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Stolidobranchia; family: Styelidae; genus: *Symplegma*; specificEpithet: *oceania*; scientificNameAuthorship: Tokioka, 1961; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM04; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Indonesia, Hong Kong, China (People's Republic), Palau, New Caledonia, Fiji, Sri Lanka, Northern Territory (N coast), Queensland (Central East coast, Great Barrier Reef, Northeast coast), South Australia (Great Australian Bight, South Gulfs coast), Victoria (Bass Strait), Western Australia (Central West coast, Lower West coast, Northwest coast); Noumea, also West Indian Ocean, Gulf of Mexico, Caribbean.

Distribution in India: Thoothukudi coast, Leepuram, China Muttom, Colachel & Vizhinjam Bay.

Styela canopus (Savigny, 1816)

- Encyclopedia of Life http://eol.org/pages/503604/overview

Material

a. taxonID: Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Stolidobranchia; family: Styelidae; genus: *Styela*; specificEpithet: *canopus*; scientificNameAuthorship: (Savigny, 1816); continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Dislodging; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM05; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Japan, France, Indonesia, Hong Kong, New South Wales (Central East coast), Queensland (Central East coast, Northeast coast), Western Australia (Lower West coast, Northwest coast); Torres Strait, Coral Sea, west Pacific Ocean, Korea, tropical and temperate Atlantic Ocean, Persian Gulf, Adriatic, Mediterranean, Ascension Is., Channel Is., west coast of France.

Distribution in India: Thoothukudi coast and Vizhinjam Bay.

Microcosmus exasperatus Heller, 1878

- Encyclopedia of Life http://eol.org/pages/514239/overview

Material

a. taxonID: Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Stolidobranchia; family: Pyuridae; genus: *Microcosmus*; specificEpithet: *exasperatus*; scientificNameAuthorship: Heller, 1878; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Dislodging; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM06; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Fiji, Philippines, Hawaii, New Caledonia, Bermuda, Brazil, Indonesia, Florida, New South Wales (Central East coast, Lower East coast), Northern Territory (North coast), Queensland (Central East coast, Northeast coast), Western Australia (Central West coast, Lower West coast, North coast, Northwest coast); West Indies, East Africa, Red Sea.

Distribution in India: Thoothukudi coast, Chinna Muttom and Vizhinjam Bay.

Microcosmus propinquus Herdman, 1882

- Encyclopedia of Life http://eol.org/pages/514253/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Stolidobranchia; family: Pyuridae; genus: *Microcosmus*; specificEpithet: *propinquus*; scientificNameAuthorship: Herdman, 1882; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Dislodging; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM07; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia

Distribution in India: Vizhinjam Bay.

Eudistoma carnosum Kott, 1990

- Encyclopedia of Life http://eol.org/pages/513439/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polycitoridae; genus: *Eudistoma*; specificEpithet: *carnosum*; scientificNameAuthorship: Kott, 1990; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM08; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID:

IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia

Distribution in India: Mandapam.

Eudistoma gilboviride (Sluiter, 1909)

- Encyclopedia of Life http://eol.org/pages/513450/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polycitoridae; genus: *Eudistoma*; specificEpithet: *gilboviride*; scientificNameAuthorship: (Sluiter, 1909); continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 8; day: 27; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM09; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/03; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Central Indo-Pacific.

Distribution in India: Gulf of Mannar.

Eudistoma pyriforme (Herdman, 1886)

- Encyclopedia of Life http://eol.org/pages/513493/overview

Material

a. taxonID: Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polycitoridae; genus: *Eudistoma*; specificEpithet: *pyriforme*; scientificNameAuthorship: (Herdman, 1886); continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 3; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM10; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Madagascar, Central Indo-Pacific.

Distribution in India: Tiruchendur.

Eudistoma viride Tokioka, 1955

- Encyclopedia of Life http://eol.org/pages/513512/overview

Material

a. taxonID: Established Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polycitoridae; genus: *Eudistoma*; specificEpithet: *viride*; scientificNameAuthorship: Tokioka, 1955; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2015; month: 2; day: 9; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 5; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM11; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2015; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/04; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Central Indo-Pacific.

Distribution in India: Thoothukudi coast.

Synoicum galei Kott, 1992

- Encyclopedia of Life http://eol.org/pages/513842/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Synoicum*; specificEpithet: *galei*; scientificNameAuthorship: Kott, 1992; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 5; day: 12; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 3; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM12; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/02; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia

Distribution in India: Mandapam.

Polyclinum glabrum Sluiter, 1895

- Encyclopedia of Life http://eol.org/pages/513775/overview

Material

a. taxonID: Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Polyclinum*; specificEpithet: *glabrum*; scientificNameAuthorship: Sluiter, 1895; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 5; day: 12; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 6; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM13; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/02; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Indonesia, Northern Territory (North coast), Queensland (Great Barrier Reef, Northeast coast), Western Australia (Northwest coast).

Distribution in India: Vizhinjam Bay.

Polyclinum nudum Kott, 1992

- Encyclopedia of Life http://eol.org/pages/513786/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Polyclinum*; specificEpithet: *nudum*; scientificNameAuthorship: Kott, 1992; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 5; day: 12; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM14; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/02; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

New South Wales (Lower East coast).

Distribution in India: Vizhinjam Bay.

Polyclinum saturnium Savigny, 1816

- Encyclopedia of Life http://eol.org/pages/513792/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Polyclinum*; specificEpithet: *saturnium*; scientificNameAuthorship: Savigny, 1816; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM15; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

North Atlantic Ocean.

Distribution in India: Vizhinjam Bay.

Polyclinum solum Kott, 1992

- GBIF http://www.gbif.org/species/5200515

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Polyclinum*; specificEpithet: *solum*; scientificNameAuthorship: Kott, 1992; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM16; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia, Indonesia.

Distribution in India: Gulf of Mannar.

Polyclinum tenuatum Kott, 1992

- Encyclopedia of Life http://eol.org/pages/513797/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Polyclinum*; specificEpithet: *tenuatum*; scientificNameAuthorship: Kott, 1992; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 5; day: 12; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM17; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/02; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia.

Distribution in India: Chinna Muttom and Leepuram.

Aplidiopsis confluata Kott, 1992

- Encyclopedia of Life http://eol.org/pages/513543/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Polyclinidae; genus: *Aplidiopsis*; specificEpithet: *confluata*; scientificNameAuthorship: Kott, 1992; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Hand picking; year: 2014; month: 5; day: 12; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 2; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM18; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/02; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia

Distribution in India: Vizhinjam Bay.

Trididemnum caelatum Kott, 2001

- Encyclopedia of Life http://eol.org/pages/513175/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Trididemnum*; specificEpithet: *caelatum*; scientificNameAuthorship: Kott, 2001; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM19; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia.

Distribution in India: Mandapam.

Trididemnum clinides Kott, 1977

- Encyclopedia of Life http://eol.org/pages/513178/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Trididemnum*; specificEpithet: *clinides*; scientificNameAuthorship: Kott, 1977; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM20; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

South Pacific Ocean.

Distribution in India: Thoothukudi coast and Vizhinjam Bay.

Trididemnum cyclops Michaelsen, 1921

- Encyclopedia of Life http://eol.org/pages/513180/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Trididemnum*; specificEpithet: *cyclops*; scientificNameAuthorship: Michaelsen, 1921; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM21; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

South Pacific Ocean.

Distribution in India: Colachel.

Trididemnum savignii (Herdman, 1886)

- Encyclopedia of Life http://eol.org/pages/513210/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Trididemnum*; specificEpithet: *savignii*; scientificNameAuthorship: (Herdman, 1886); continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM22; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Indonesia, Bermuda, Florida, Northern Territory (North coast), Queensland (Northeast coast), Western Australia (Northwest coast); West Indies.

Distribution in India: Thoothukudi and Colachel.

Tridemnum vermiforme Kott, 2001

- Encyclopedia of Life http://eol.org/pages/513223/overview

Material

a. taxonID: Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Tridemnum*; specificEpithet: *vermiforme*; scientificNameAuthorship: Kott, 2001; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM23; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia.

Distribution in India: Mandapam.

Didemnum psammatodes (Sluiter, 1895)

- Encyclopedia of Life http://eol.org/pages/512886/overview

Material

a. taxonID: Established Cryptogenic; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Didemnum*; specificEpithet: *psammathodes*; scientificNameAuthorship: (Sluiter, 1895); continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2015; month: 2; day: 9; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 4; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM24; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2015; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/04; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Japan, Malaysia, Indonesia, New Zealand, New South Wales (Central East coast), Queensland (Central East coast, Great Barrier Reef, Northeast coast), Victoria (Bass Strait); west Indian Ocean, Red Sea.

Distribution in India: Thoothukudi coast, Leepuram, Chinna Muttom and Vizhinjam Bay.

Didemnum spadix Kott, 2001

- Encyclopedia of Life http://eol.org/pages/512900/overview

Material

a. kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Didemnum*; specificEpithet: *spadix*; scientificNameAuthorship: Kott, 2001; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2014; month: 3; day: 15; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 1; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM25; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2014; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/01; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Australia.

Distribution in India:: Mandapam.

Lissoclinum bistratum Sluiter, 1905

- Encyclopedia of Life http://eol.org/pages/513037/overview

Material

a. taxonID: Invasive; kingdom: Animalia; phylum: Tunicata; class: Ascidiacea; order: Aplousobranchia; family: Didemnidae; genus: *Lissoclinum*; specificEpithet: *bistratum*; scientificNameAuthorship: Sluiter, 1905; continent: Asia; country: India; stateProvince: Tamil Nadu; municipality: Ramanathapuram; locality: Mandapam; locationRemarks: Intertidal flats and shallow water; decimalLatitude: 9.2856; decimalLongitude: 79.1586; samplingProtocol: Peeling off; year: 2015; month: 2; day: 9; eventRemarks: H. Abdul Jaffarali, A. Soban Akram, M.L. Kaleem Arshan; individualCount: 4; sex: Hermophrodite; lifeStage: adult; catalogNumber: DBTICMPM26; recordedBy: Abdul Jaffarali et al.; identifiedBy: Dr. H. Abdul Jaffar Ali; dateIdentified: 2015; type: Physical Object; language: en; institutionID: IC; collectionID: MPM/PB/04; collectionCode: Ascidians; basisOfRecord: PreservedSpecimen

Distribution

Djibouti, South Pacific Ocean, Tanzania.

Distribution in India: Thoothukudi.

Discussion

A total of 30 species of ascidians, comprising 6 families and 11 genera, from the Mandapam water has been reported in the present study (Suppl. material 1). Out of 30 species, 26 were new to this station, among which 5 species: *Ecteinascidia turbinata*, *Eudistoma carnosum*, *Tridemnum caelatum*, *T. vermiforme* and *Didemnum spadix*, were reported for the first time in India. The other 4 species were previously documented at the study area and are considered non-native species. The total number of ascidian species (n=30) is greater than previously documented (n=19) in 2003, thus increasing biodiversity. This new entry of ascidians to the study station could possibly be explained by invasiveness of ascidians and vectors such as the hulls of ships and ballast water (Byers 2002). Heavy traffic of shipping and fishing vessels acts as an important vector for intra and inter coastal spread of invaders (Johnson et al. 2001, Wasson et al. 2001, Darbyson 2009, Rocha et al. 2010).

Previously, a total of 19 ascidian species was reported from this station (Meenakshi 1997, Meenakshi 1998, Meenakshi 1999, Meenakshi 2002, Meenakshi 2003, Meenakshi 2006, Meenakshi 2009, Renganathan 1984a, Renganathan 1984b), among which only four species (*Eudistoma ovatum*, *E. reginum*, *E. tumidum* and *Polyclinum fungosum*) were encountered in the present study. The increasing number of new entries of ascidians and absence of previously reported species at this station may be due to changes in physico-geographical structures such as expanding of fishing harbour, establishment of new jetties and heavy traffic of fishing vessels.

The diversity of ascidians is influenced by the development of coastal patterns and environmental impacts (Carman et al. 2007). Ascidians are common inhabitants of harbours and marinas in both temperate and tropical waters (Monniot et al. 1991). They can easily be translocated by ships as well as boats and also through ballast water due to their motile larvae and sedentary adults. The dimension of ascidian diversity and increased invasive state of ascidians is influenced by coastal shipping patterns (Carman et al. 2011).

The Mandapam station has lots of substrata such as jetties, embedded rocks, small stones, fishing and coastguard vessels providing a suitable environment for the settlement of ascidians in a subtropical habitat.

Members of the family Polyclinidae occured in huge numbers throughout the study period with maximum colony size during summer season (March-May). *Ecteinascidia venui* was recorded in large numbers during premonsoon season (June-August). Ascidians are

seasonal recruiters (Tamilselvi et al. 2012). Other ascidian species had sporadic occurrences throughout the study period.

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References

- Abdul Jaffar Ali H (2004) Comparative study on ecology of *Phallusia nigra* Savigny 1816 from Tuticorin (southeast coast) and Vizhinjam (southwest coast). Manonmaniam Sundaranar University, Tirunelveli, India, 235 pp.
- Abdul Jaffar Ali H, Tamilselvi M, Sivakumar V (2011) Marine ascidian biodiversity – a promising resource for bioactive compounds. Journal of Advanced Biotechnology 10 (10): 126-132.
- Abdul Jaffar Ali H, Tamilselvi M, Soban AA, Arshan MLK, Sivakumar V (2015) Comparative study on bioremediation of heavy metals by solitary ascidian, Phallusia nigra, between Thoothukudi and Vizhinjam ports of India. Ecotoxicology and Environmental Safety 121: 93-99. DOI: 10.1016/j.ecoenv.2015.04.052
- Byers J (2002) Impact of non-indigenous species on natives enhanced by anthropogenic alteration of selection regimes. Oikos 97 (3): 449-458. DOI: 10.1034/j.1600-0706.2002.970316.x
- Carman M, Bullard SG, Donnelly JP (2007) Water quality, nitrogen pollution, and ascidian diversity in coastal waters of southern Massachusetts, USA. Journal of Experimental Marine Biology and Ecology 342 (1): 175-178. DOI: 10.1016/j.jembe.2006.10.037
- Carman M, Bullard S, Rocha R, Lambert G, Dijkstra J, Roper J, Goodwin A, Carman M, Vail E (2011) Ascidians at the Pacific and Atlantic entrances to the Panama Canal. Aquatic Invasions 6 (4): 371-380. DOI: 10.3391/ai.2011.6.4.02
- Darbyson E (2009) Marine boating habits and the potential for spread of invasive species in the Gulf of St. Lawrence. Aquatic Invasions 4 (1): 87-94. DOI: 10.3391/ai.2009.4.1.9
- Davidson B (1993) Ascidians: producers of amino acid-derived metabolites. Chemical Reviews 93 (5): 1771-1791. DOI: 10.1021/cr00021a006
- Haefner B (2003) Drugs from the deep: marine natural products as drug candidates. Drug Discovery Today 8 (12): 536-544. DOI: 10.1016/s1359-6446(03)02713-2
- Jain R, Sonawane S, Mandrekar N (2008) Marine organisms: Potential source for drug discovery. Current Science 94 (3): 292. URL: http://www.currentscience.ac.in/Downloads/article_id_094_03_0292_0292_0.pdf

- Johnson LE, Ricciardi A, Carlton JT (2001) OVERLAND DISPERSAL OF AQUATIC INVASIVE SPECIES: A RISK ASSESSMENT OF TRANSIENT RECREATIONAL BOATING. Ecological Applications 11 (6): 1789-1799. DOI: 10.1890/1051-0761(2001)011[1789:odoais]2.0.co;2
- Kott P (1985) The Australian Ascidiacea, Part 1. Phlebobranchia and Stolidobranchia. Memoirs of the Queensland Museum 23: 1-440.
- Kott P (2001) The Australian Ascidiacea part 4, Aplousobranchia (3), Didemnidae. Memoirs of the Queensland Museum 47: 1-408.
- Meenakshi VK (1997) Biology of a few chosen ascidians. Manonmaniam Sundaranar University, Tirunelveli, 253 pp.
- Meenakshi VK (1998) Three species of polyclinid ascidians – New records to Indian waters. Journal of the Marine Biological Association of India 40 (1): 201-205.
- Meenakshi VK (1999) *Phallusia poytrema* (Herdman, 1906) - a new record to Indian waters. Geobios new Reports 18: 61-63.
- Meenakshi VK (2002) Occurrence of a new species of colonial ascidian *Eudistoma kaverium* sp. nov. and four new records of *Eudistoma* to Indian coastal waters. Indian Journal of Marine Sciences 31 (3): 201-206.
- Meenakshi VK (2003) Marine biodiversity – Taxonomy of Indian ascidians. Final Technical Report. Ministry of Environment and Forests, New Delhi, 103 pp.
- Meenakshi VK (2006) Two new styelid ascidians – *Polycarpa maniensis* sp. nov., *Polycarpa scatterata* sp. nov. and one new record *Polycarpa aurita* (Sluiter, 1890) from Indian waters. Journal of the Marine Biological Association of India 48 (1): 95-99.
- Meenakshi VK (2009) New records of five species of colonial ascidians of the genus *Ecteinascidia* Herdman, 1880 from the Gulf of Mannar. Journal of the Bombay Natural History Society 106 (1): 107-112.
- Millar R (1975) Ascidians from the Indo-West-Pacific region in the Zoological Museum, Copenhagen (Tunicata, Ascidiacea). Steenstrupia. Zoological Museum, University of Copenhagen, Copenhagen 3 (20): 205-335.
- Monniot C, Monniot F, Laboute P (1991) Coral Reef Ascidians of New Caledonia. Editions de l'Orstom, Paris, France, 247 pp.
- Monniot F, Monniot C (1996) New Collections of Ascidians from the Western Pacific and Southeastern Asia. Micronesica 29 (2): 133-279.
- Nanri K, Ogawa J, Nishikawa T (1992) Tunic of pyurid ascidian *Microcosmus hartmeyeri* Oka is eaten locally in Japan. Nanki Seibutu 34 (2): 135.
- Renganathan TK (1984a) *Ecteinascidia garstangi*, Sluiter 1898 – a colonial ascidian not hitherto been recorded from India. Geobios new Reports 3: 54-55.
- Renganathan TK (1984b) *Aplidium multiplicatum* Sluiter, 1909 – a new record for the Indian waters. Geobios new Reports 3: 155-156.
- Renganathan TK (1986) Studies on the ascidians of south India. Madurai Kamaraj University, Madurai, India, 320 pp.
- Rinehart KL (2000) Antitumor compounds from tunicates. Medicinal Research Reviews 20 (1): 1-27. DOI: 10.1002/(sici)1098-1128(200001)20:13.3.co;2-1
- Rocha RM, Guerra-Castro E, Lira C, Pauls SM, Hernández I, Pérez A, Sardi A, Pérez J, Herrera C, Carbonini AK, Caraballo V, Salazar D, Diaz MC, Cruz-Motta JJ (2010) Inventory of ascidians (Tunicata, Ascidiacea) from the National Park La Restinga, Isla Margarita, Venezuela. Biota Neotropica 10 (1): 209-218. DOI: 10.1590/s1676-06032010000100021

- Sebastian VO (1956) *Symplegma viride* Herdman and *Symplegma viride* Stolonica Berril, two unrecorded fouling organisms from Indian seas. Journal of Timb Dry Preserve Association of India 11 (3): 2-4.
- Tamilselvi M (2008) Ecological studies on ascidians of Tuticorin coast. Manonmaniam Sundaranar University, Tirunelveli, India, 350 pp.
- Tamilselvi M, Abdul Jaffar Ali H, Thilaga RD (2012) Diversity and seasonal variations of Class Ascidiacea in Thoothukudi coast, India. International Journal of Environmental Sciences 3 (3): 1097-1115.
- Tamilselvi M, Sivakumar V, Abdul Jaffar Ali H, Thilaga RD (2010) Preparation of pickle from *Herdmania pallida*, simple ascidian. World Journal of Dairy & Food Sciences 5 (1): 88-92.
- Tokioka T (1967) Pacific Tunicata of the United States National Museum. Bulletin of the United States National Museum 251: 1-247. DOI: 10.5479/si.03629236.251.1
- Venkataraman K (2003) Natural Aquatic Ecosystems of India, National Biodiversity Strategy Action Plan, Thematic Biodiversity Strategy and Action Plan. Zoological Survey of India, Kolkata, 272 pp.
- Wasson K, Zabin CJ, Bedinger L, Diaz MC, Pearse JS (2001) Biological invasions of estuaries without international shipping: the importance of intraregional transport. Biological Conservation 102 (2): 143-153. DOI: 10.1016/s0006-3207(01)00098-2

Supplementary material

Suppl. material 1: Members of various ascidian families recorded in the present study

Authors: Jaffarali, Akram & Arshan

Data type: Statistical

Brief description: Figure shows the number of genus and species represented in the families of ascidians.

Filename: Members of various ascidian families.xlsx - Download file (11.33 kb)